THE OIL AND GAS POTENTIAL IN THE HIGH NORTH - cluster development in the sub-contractor systems and open innovation opportunities

Professor Dr. ekon. Odd Jarl Borch.
Focus

• Oil and gas opportunities in the North
• Offshore challenges in Arctic environments
• Industrial context of Northern Norway
• Networks and cluster development
• Open innovation concepts, R&D partnerships and M&A strategies
CV Professor Odd Jarl Borch

- Master of Science Norwegian School of Economics and Business Administration, Bergen
- Doctoral studies and PhD, Umeå university, Sweden
- Post doc studies Indiana University, USA
- Master Mariner Diploma, Bodin Maritime School, Bodø
- Professor University of Nordland
- Research Coordinator Nordland Research Institute
- Professor (part time), University of Stavanger
- Strategic management and entrepreneurship research
- Research on fisheries, fish farming, agro-food, reg.dev
- Present focus: maritime business, oil and gas
- Advisor government institutions at different levels
- Approx 150 research publications
Facts about the University of Nordland

• Established as regional university college in 1973
• National full university status 2011
• More than 100 study programs
• Approx 5500 students
• 600 employees
University of Nordland faculties:

- Bioscience and aquaculture
- Social Science
- Professional studies
- Bodø Graduate School of Business
Bodo Graduate School of Business

• No. 3 business school in Norway
• European top ten on Entrepreneurship research
  ➢ Focus on High North Research
  ➢ Several research centres:
    ➢ Center for the High North
    ➢ Nordland Research Institute
Opportunities in the High North

- Oil and gas a significant source of energy for the next decenniums.
- Present resources will run out in 30-40 years period
- Rising prices will stimulate increased efforts towards resource exploration
- 20-25% of the unexplored resources expected to be localized in the Arctic
- Increased activity towards both research, construction and field support in Arctic waters
- Axis Greenland to Kara Sea natural “home market” for Norwegian companies
Energy Resources in the Arctic

22% of the World's undiscovered petroleum resources in the Arctic?

- Rest of the World
- North Africa, Middle East, Caspian Sea
- Arctic

1. South Kara Sea
2. North Kara Sea
3. Laptev Sea
4. East Siberian Sea
5. Chukchi Sea
6. Alaska North Slope
7. East Greenland
8. Barents Sea
8. februar 2012 **Strenghtening Barents-survey**

Statsminister Jens Stoltenberg varsler at regjeringen setter i gang geologisk kartlegging også lengre nord i det tidligere omstridte området i Barentshavet.

9. februar 2012 **Gathering seismic in the Barents Sea**

Electromagnetic Geoservices ASA (EMGS) har sikret seg forhåndsmidler for å starte en multiklient 3D EM-undersøkelse i Barentshavet.

10. februar 2012 **Shooting in the Barents Sea**

SeaBird Exploration PLC har blitt hyret av en gruppering av ikke navngitte selskaper for å utføre en 2D-undersøkelse i Barentshavet.

Source: PetroNews weekend Febr 10, 2012
<table>
<thead>
<tr>
<th>Field</th>
<th>Type</th>
<th>Operator</th>
<th>Sea Area</th>
<th>Status</th>
<th>Time Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Norne Olje/gass</td>
<td>STATOIL</td>
<td>Norskehavet</td>
<td>I drift</td>
<td>1997-2021</td>
<td></td>
</tr>
<tr>
<td>Snøhvit Gass</td>
<td>STATOIL</td>
<td>Barentshavet Sørvest</td>
<td>I drift</td>
<td>2007-</td>
<td></td>
</tr>
<tr>
<td>Skarv Olje/gass</td>
<td>BP</td>
<td>Norskehavet</td>
<td>utbygging 36mrd</td>
<td>2012-2037</td>
<td></td>
</tr>
<tr>
<td>Goliat Olje/gass</td>
<td>ENI</td>
<td>Barentshavet Sørvest</td>
<td>Under utbyg. 28mrd</td>
<td>2013-2028</td>
<td></td>
</tr>
<tr>
<td>Luva-Snefrid, Gass</td>
<td>STATOIL</td>
<td>Norskehavet</td>
<td>PUD 2012 34mrd</td>
<td>2017-</td>
<td></td>
</tr>
<tr>
<td>Linnorm Gass</td>
<td>SHELL</td>
<td>Norskehavet</td>
<td>PUD2013? 10 mrd</td>
<td>2017-</td>
<td></td>
</tr>
<tr>
<td>Asterix Gass</td>
<td>STATOIL</td>
<td>Norskehavet</td>
<td>PUD2013: 10 mrd</td>
<td>2017-</td>
<td></td>
</tr>
<tr>
<td>Victoria Gass</td>
<td>TOTAL</td>
<td>Norskehavet</td>
<td>PUD2013? 10 mrd</td>
<td>2017-</td>
<td></td>
</tr>
<tr>
<td>Nucula Olje/gass</td>
<td>STATOIL</td>
<td>Barentshavet Sørvest</td>
<td>Avgrensningsboring</td>
<td>2017-</td>
<td></td>
</tr>
<tr>
<td>Skrugard/Havis Olje/gass</td>
<td>STATOIL</td>
<td>Barentshavet Sørvest</td>
<td>Avgrensningsboring</td>
<td>2017-</td>
<td></td>
</tr>
<tr>
<td>Norvarg Olje/gass</td>
<td>TOTAL</td>
<td>Barentshavet Sørvest</td>
<td>Avgrensningsboring</td>
<td>2017-</td>
<td></td>
</tr>
<tr>
<td>Skalle Olje/gass</td>
<td>LUNDIN</td>
<td>Barentshavet Sørvest</td>
<td>Avgrensningsboring</td>
<td>2017-</td>
<td></td>
</tr>
<tr>
<td>Heilo Olje/gass</td>
<td>North energy</td>
<td>Barentshavet Sørvest</td>
<td>Leteboring</td>
<td>2017-</td>
<td></td>
</tr>
<tr>
<td>Storebjørn</td>
<td>Det norske</td>
<td>Barentshavet Sørvest</td>
<td>Leteboring</td>
<td>2017-</td>
<td></td>
</tr>
<tr>
<td>Jan Mayen-Greenland</td>
<td></td>
<td>Nord og vest Island</td>
<td>Seismikk 2012</td>
<td>2017-</td>
<td></td>
</tr>
<tr>
<td>Barentshavet Sørøst</td>
<td></td>
<td>Delelinjeområdet</td>
<td>Seismikk 2011-2013</td>
<td>2017-</td>
<td></td>
</tr>
<tr>
<td>Barentshavet Nordøst</td>
<td></td>
<td>Delelinjeområde</td>
<td>Seismikk 2012</td>
<td>2017-</td>
<td></td>
</tr>
<tr>
<td>Bjørnøyvifta</td>
<td></td>
<td>Kontroversielle omr</td>
<td>2017-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Troms II</td>
<td></td>
<td>Kontroversielle omr</td>
<td>2017-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nordland IV-VII</td>
<td></td>
<td>Kontroversielle omr</td>
<td>2017-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Established and near future oil and gas fields in the Northern part of Norway
Examples of activities

• Number of operational wells in the Barents Sea:
  – 2012: 30 wells
  – 2015: 60 wells (including Snøhvit train II and Skrugard/Havis)

• Engineering companies in the North
  – Aibel, Hammerfest
  – Aker Solutions (Tromsø, Narvik)
  – Aker Subsea (Hammerfest)

• Several M&S: Aker, Westcon, Langset
Oil supply bases

- Sandnessjøen (Asco, CCB)
- Harstad (CCB)
- Skjervøy (Asco)
- Harstad (NorSea Group)
- Hammerfest (CCB, Asco)
- Vardø (CCB)
- Kirkenes (CCB, Asco)
Challenges in the North

- Several small fields
- Transportation to market
- Weather – polar lows
- Distance to base
- Darkness
- Ice/icing
- Environmental focus
- Infrastructure challenges
Important to understand that you are moving into a very different context: - North Sea - Arctic Low Region - Arctic High Region
”Exploration in the North is in general a high risk activity. Lack of infrastructure makes development relatively costly, with long lead time”.

Harald Karlstrøm, Managing Director North Energy, Alta to Petro Media 3.2.12
Low Arctic (sub-arctic) region

- New Foundland
- Greenland South
- Jan Mayen
- Barents Sea South
- Lofoten to Barents Sea South
High Arctic Region

1. Alaska-region Beaufort Sea – Chukchi
2. Newfoundland to Baffin Bay
3. Nuuk to Thule – West Greenland
4. Denmark Strait to the Greenland Sea (West Ice)
5. North-east Greenland to Spitsbergen East (North Ice)
6. White Sea to Novaya Zemlya (East Ice)
7. Kara Sea
Operational challenges

Complexity:
(no of stakeholders, size of expedition, interlinks, rules, regulations)

Turbulence/dynamism
Lack of predictability
-weather,
-darkness
-ice,
-security
-technology

Mexican Gulf

North Sea

Norwegian Sea

Barents Sea South/ Greenland SW

Barents Sea East and North

Greenland North East

Lofoten region
## Differences operational environment

<table>
<thead>
<tr>
<th></th>
<th>The North Sea</th>
<th>The Low Arctic</th>
<th>The High Arctic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polar lows</td>
<td>++</td>
<td>+++</td>
<td>++++</td>
</tr>
<tr>
<td>Visibility (fog, darkness)</td>
<td>+</td>
<td>++</td>
<td>++++</td>
</tr>
<tr>
<td>Icing and sea ice</td>
<td>-</td>
<td>++</td>
<td>++++</td>
</tr>
<tr>
<td>Distances to base</td>
<td>+</td>
<td>++</td>
<td>++++</td>
</tr>
<tr>
<td>Lack of infrastructure</td>
<td>-</td>
<td>++</td>
<td>+++++</td>
</tr>
<tr>
<td>Lack of research</td>
<td>-</td>
<td>++</td>
<td>++++</td>
</tr>
<tr>
<td>Interest groups</td>
<td>+</td>
<td>++++</td>
<td>+++++</td>
</tr>
<tr>
<td>Political risk</td>
<td>+</td>
<td>+++</td>
<td>+++++</td>
</tr>
</tbody>
</table>
Example: Goliat field (ENI)

• First oil field developed in the Barents Sea
  – 28 bill Sm3 oil, 8 bill Sm3 gas – min: 15 years

• Production concept: Floater - Sevan 1000 special design, winterized -20°C, redundancy, new loading/discharging system, clean design

• Costs
  – Investments 28 bill NOK
  – Running costs: 1 bill NOK per year

• 22 wells all year drilling 2012-2017
  – Saipem rig: Scarabeo 8 special designed
  – Winterization -20°C, high technology
Eni: Goliat –winterized units

New task forces for oil spill preparedness
–NOFO barrier 1 and 2
Coastal barrier with fishing fleet
EXAMPLE: The Shtokman project

• Field context
  – Large production volumes, long project period
  – New technology
  – Long distances to base
  – Poor infrastructure
  – Winter ice of various thickness (dimensioning for up to 2m first year ice)
  – Ice bergs in Summer time
  – Subject to harsh and unpredictable polar storms
  – Extreme HME-challenges

• Broader range of offshore service operations
  – Subsea installation support
  – Inspections and interventions
  – All year stand-by in ice, All year supply in ice
  – Towing of ice bergs
  – De-coupling and towing of installations due to ice threats
  – Fighting of pollution and rescue in icy waters
POSSIBLE CONTEXT FOR THE SHTOKMAN FIELD
Distances to base
N 74º– 320nm (600km) til Murmansk
TRANSPORT IN THE NORTH-Northern Sea Route to Asia
Northern Sea Route

• Saves 40% av transport time between Northern Europe and Japan

• 2011: 27 vessels

• 2012: Knudsen OAS -first transport of LNG-gas from Snøvit field via Northern Sea route
  – 20 dager from Hammerfest to Japan

• Demanding ice class vessels and ice breaker assistance

Special logistics and sailing competence
New technological demands in the North

- As little as possible above surface
- Subsea solutions to avoid ice and icing
- Zero omission – high clean design
- Winterization
- Redundancy for safety
- High efficiency focus
- Very high pollution preparedness
- Participation in infrastructure development
Business capacity and competence in the North - what resources are present?
# Offshore related resources in the North

<table>
<thead>
<tr>
<th>Category</th>
<th>NORWAY</th>
<th>NORTHERN NORWAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep Sea shipping and offshore comp.</td>
<td>163</td>
<td>4</td>
</tr>
<tr>
<td>Short sea shipping (cargo) companies</td>
<td>270</td>
<td>30</td>
</tr>
<tr>
<td>Passenger ship companies</td>
<td>50</td>
<td>7</td>
</tr>
<tr>
<td>Larger fishing vessel companies</td>
<td>207</td>
<td>34</td>
</tr>
<tr>
<td>Smaller fishing vessels (vessel owners)</td>
<td>7000</td>
<td>3000</td>
</tr>
<tr>
<td>Maritime equipment producers/exporters</td>
<td>120</td>
<td>7</td>
</tr>
<tr>
<td>Members oil and gas export network</td>
<td>215</td>
<td>8</td>
</tr>
<tr>
<td>Oil &amp; gas companies</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>Shipbuilding yards</td>
<td>20</td>
<td>2</td>
</tr>
<tr>
<td>Larger yards</td>
<td>120</td>
<td>13</td>
</tr>
<tr>
<td>Smaller (repair) yards</td>
<td>120</td>
<td>13</td>
</tr>
<tr>
<td>Norwegian Seamen association</td>
<td>9900</td>
<td>2000</td>
</tr>
<tr>
<td>Maritime Network organization</td>
<td>700</td>
<td>50</td>
</tr>
</tbody>
</table>
From loose networks to oil and gas development clusters in the North
Development phases of clusters

• **Bubbles**
  – Early phase interaction
    Needs input of: competence, capital, demanding customers, relations

• **Micro-clusters**
  – Regional limited interaction single firms
  – Needs input of: complementary ind., links to national arena, input (competence), competitors

• **Established complete clusters**
  – Need additional stimuli, f.ex. advanced competence, R&D, new actors, int. competition
A EXTRA CHALLENGE TO CREATE STRONG PARTNERSHIPS AND CLUSTER CONSTELLATIONS IN MATURE INDUSTRIES?

- conservatism among owners
- family firms
- lack of risk capital
- limited strategic apex in firms
- lack of tradition for cooperation
- limited R&D activity
Open innovation principles a solution?

1. Establish internal R&D group internally
2. Top management dedication
3. Clear vision and development objective
4. Dedicated competence resources (manhours)
5. Clearify the resources lacking
6. Search partners with best practice:
   - Find firms with the best R&D staff
   - Include research institutions as support
Principles of partner search

1. Search for established networks
2. Join present networks in region
3. Map regional innovation systems
4. Search for dynamic researchers
5. Check out merit list for project financing
6. Tap into a present research projects or establish a new ones
Present industry networks in the North

• Mechanical industry
  – Helgeland V&M (Center: Sandnessjøen)
  – Hålogaland Olje &Energi (Center: Harstad)
  – Finnmark V&M (Center: Hammerfest)

• The yards association of the North

• Maritime Forum North

• The Arctic-Maritime cluster project

• The petro-maritime cluster project

• Arena Environment protection
Challenges in mature industries

- Lack of entrepreneurial orientation
  - Risk, proactiveness, innovativeness
- Lack of radical, high speed innovation
- Reliance on "Doing-Using-Interacting Mode"
  - emphasize on incremental improvement, learning by using, tacit knowledge transfer
- The oil and gas environment needs a Science, Technology, Innovation Mode
  - R&D emphasis and partnerships
Example: The Arctic Maritime Cluster

1. From ad hoc, informal ties to formal network organization (Maritime Forum national network)
2. Building regional maritime innovation system (universities, research, institutes)
   - link up to national Maritime 21 R&D program
3. R&D Partnerships national and international
4. Higher maritime management education
5. Cluster organization
6. Government institutional network (Innovation Norway Arena-program)
7. Center of excellence Arctic maritime operations
General principles of R&D agreements

- Check out capacity presented by partners
- Have a dedicated and authorized project leader
- Make clear who is participating from each firm
- Establish formal contracts including budgets
- Start with trust developing measures (social events, travelling to exhibitions, courses, etc.)
- Delegate responsibility to sub-groups and set milestones
- Arrange seminars for management to show achievements

Clear contracts with research institutions
Need to build adequate research infrastructure

• International research networks
• Specialized innovations systems
• Knowledge-intensive service industry (consultants)
• R&D competence within the firm
• R&D institutions with frontier competence
• R&D financial support
Research institutions in the North

• Business
  – University of Nordland/Nordlandsforskning - Harstad College- University of Tromsø

• Technical:
  – Narvik technical College/Norut Teknologi - University of Tromsø/Norut Tromsø

• Maritime:
  – Universities of Tromsø and Nordland

• Regional effects/society:
  – University of Nordland/Nordlandsforskning-Finnmark/Norut Alta –Univ. iTromsø
With links to national and international research institutions

- NTNU - Sintef
- University of Stavanger
- Handelshøyskolen BI
- Norges handelshøyskole
- Etc.
Principles of Innovation management

• Evaluate the potential for your firm of research findings
• Involve top and middle management in discussion on implications
• Search for commercial implementation solutions
  – to improve present business platform/strategy
  – within a new business platform
  – as a spin off
  – as a spin out
The open innovation opportunities in the North

• Several local firms with growth orientation
• Open and friendly atmosphere
• Need for achievements approach
• Young research institutions with ambitions
• Potential that may be refined with added experience from the North Sea
• More financial capital needed
• Good platform for mergers & acquisitions
• National and regional government willing to
WELCOME TO NORTHERN NORWAY!
Konklusjon

• Mange aktører i nord med forskjellige behov
• Største forskjeller går mellom sesong- og helårlig drift og breddegrad
• Utfordringer knyttet til uforutsigbarhet og kompleksitet gjør at organisasjon, ledelse og styringsproblematikk blir viktigere enn før
• Viktig å vurdere ulike operasjonstyper når en diskuterer både utstyr, organisasjon og ledelse

• teknologi-person-organisasjonssamspill måstå sentralt i arktisk maritim FoU

NEW MEETING PLACES IN THE HIGH NORTH!